REMARKS

Favorable reconsideration and allowance of this application are requested.

1. Discussion of Amendments

By way of the amendment instructions above, claims 1 and 14 were amended and claim 3 canceled.

More specifically, claim 1 was amended in the following manner:

- The intrinsic viscosity of the UHPE, 5 to 40 dl/g was included as supported by page 6, lines 21-22 of the application.
- The diameter D_n of the spinholes was included as 0.3 to 5 mm as supported by page 5, lines 4-5.
- The subject matter of claim 3 is included in claim 1.
- DR_{solid} is now required to be at least 4 as supported by page 8, line 14 of the application.

Claim 14 was amended in the following manner:

- The suitability of the spinplate for UHPE has been introduced as a preamble expression.
- The diameter D_n of the spinholes has been included (see comments above for claim 1).

Therefore, following entry of this amendment, claims 1-2, 4-8 and 10-15 will remain pending herein for which favorable reconsideration and allowance are solicited.

2. Response to 35 USC §103(a) Rejections

The only issues remaining to be resolved in this application are the Examiner's rejection of the pending claims herein under 35 USC §103(a). Specifically, prior claims 1-8 and 10-13 attracted a rejection under 35 USC §103(a) as allegedly being "obvious", and hence unpatentable over Kavesh (USP 6,448,359), in view of Chau (USP 5,296,185) and optionally in view of Honnaker (USP 4,054,468), while prior claims 14-15 attracted a rejection under the same statutory provision based on Chau, optionally in view of Honnaker. As will become evident from the following discussion, none of the applied references is appropriate against the pending claims presented above.

(a) General Technology Background

What should not be overlooked when reviewing patentability is that the presently claimed invention relates to an improved process for spinning ultrahigh molar mass polyethylene (UHPE). UHPE is considered a "flexible chain" polymer, as opposed to "rigid chain" polymers such as aramids, e.g. poly(p-phenylene terphthalamide) and polybenzazoles (e.g. polybenzoxales (PBO)).

A main difference between rigid and flexible chains is the necessity of chain extension (or orientation) in the case of flexible polymer molecules in order to exploit the intrinsic properties of the chain. For rigid chain polymers generally the chains orient in an extended chain formation during spinning, coagulation and heat setting. For flexible chain polymers, however, the chains tend to fold upon crystallization and orientation takes place upon drawing.

Specific routes have been developed to orient the folded-chain crystals into chain-extended structures. For the gel spinning process contemplated by the presently claimed invention this means that a further drawing step takes places after spinning the fibers, with a DR_{solid} of at least 4. This drawing step is necessary to obtain an extended chain formation, and thus ultimate strength.

The solution of UHPE used in the process of the claimed invention contains molecules with different chain lengths, i.e. it is a polymer with a molecular weight distribution. Without wishing to be bound by theory, it is believed that in a conventional process, the relatively long molecules cannot be oriented and that thus the higher strengths cannot be obtained.

With the process of the presently claimed invention, however, using the specific configuration of the spinhole having an inflow zone and a contraction zone, it is believed that the long chain molecules are oriented during their passage in these zones and stay this way in the final product. As can be seen in the examples of the originally filed specification, this results in a higher tensile strength when applying the same DR_{solid}.

(b) The Applied References

Regarding the applied references cited by the Examiner, applicants note that each reference relates to spinning of a rigid chain polymer, as will be shown in detail later. In such rigid chain polymers, orientation occurs during spinning, coagulation and heat setting. Thus, the ordinarily skilled person would be entirely cognizant that no further orientation through drawing is necessary.

Since the problem of having a fraction of long chain molecules does not occur with these types of rigid chain polymers, the ordinarily skilled person would not refer to such references. Moreover, the references only describe spinholes with a relatively small diameter. This fact is understandable given the process characteristics as described above.

Turning attention to the specific applied references, applicants note that Chau relates to the spinning of polybenzazole polymers, such as PBO and PBT. These are rigid chain polymers. It can also be seen that the process of Chau consists of spinning the dope, drawing the dope filaments across a draw zone and washing and drying the filaments and taking them up. No further drawing takes place.

As has been asserted in prosecution to date, Chau does not provide information on the inflow zone having a length/diameter ratio of at least 5.

Honnaker also describes a process for drawing a rigid chain polymer, specifically poly(p-phenylene teraphthalamide). The diameter of the spinhole in Honnaker is only 0.05-0.10 mm, which is substantially smaller than that according to the presently claimed invention. In this regard, calculating the length of the counterbore in Honnaker using the numbers in column 4, lines 1 to 10, the total thickness of the spinplate in Honnaker is at most about 9 mm.

Referring now to Example 1 of the subject application, it can be calculated that the spinplate of the invention has a total thickness of 58 mm! Thus, the spinplate of the present invention is totally different in size than that in Honnaker. Moreover, the dimensions could not be derived from Honnaker.

Therefore, in view of the above comments, applicants suggest that claims 14-15 are patentably unobvious over Chau, alone or optionally with Honnaker.

The comments above are equally germane to the unobviousness of claims 1-2, 4-8 and 10-13.

As has been emphasized during previous prosecution, the spinplate of Kavesh does not have a contraction region as is defined in the pending claims herein -- it only has an entry region. Chau fails to cure this deficiency.

In this regard, the Examiner has asserted in the subject official action that it would be obvious to optimize the L_0/D_0 ratio to be at least 5 in light of Chau. However, as stated above, Chau relates to a different field of polymers and the same parameters that apply to UHPE cannot be said to immediately also obviously apply to Chau and vice versa.

Moreover, the presently claimed invention cannot be said to be simply an obvious "exchange" of the spinplate of Kavesh with a spinplate of Chau or Honnaker since the dimensions of such spinplates are substantially different. The ordinarily skilled person could not expect an improved drawability of an UHPE fiber by increasing the diameter of spinholes of Honnaker and moreover optimizing the L_o/D_0 of Chau.

Thus, the pending claims herein are patentably *un*obvious over Kavesh alone or taken together with Chau, optionally with Honnaker. Withdrawal of all rejections under 35 USC §103(a) is therefore in order.

3. Fee Authorization

The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140.

Respectfully submitted,

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